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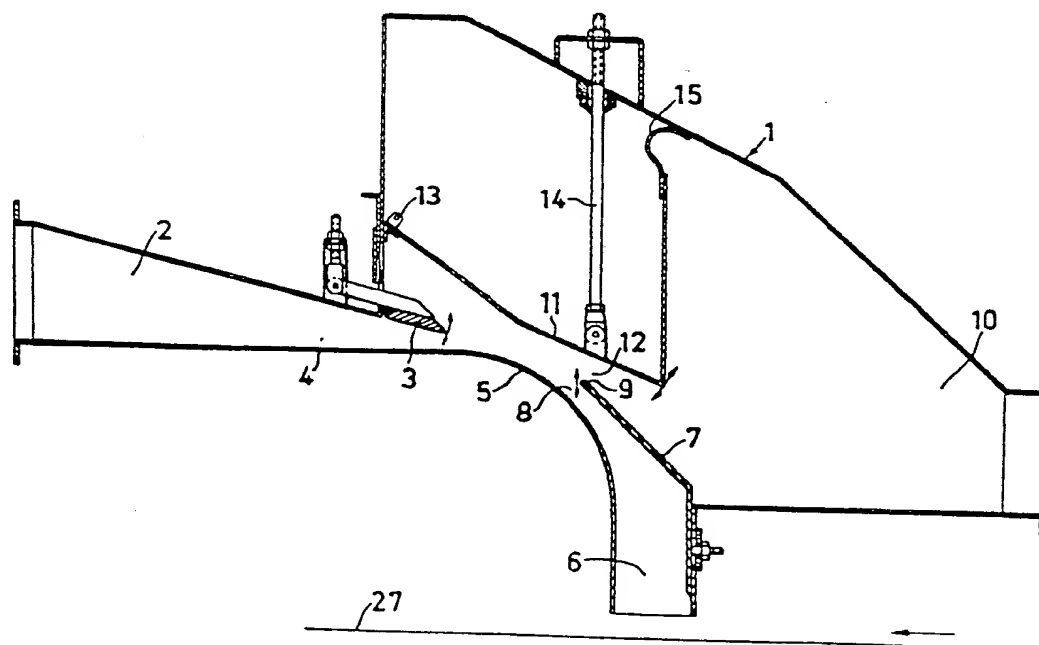
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(54) Title: METHOD AND DEVICE FOR DRY FORMING WEBS



(57) Abstract

Fibre material is defibrated and dispersed in an air flow and introduced through an inlet (2) into a forming head (1). In the forming head (1) the inlet transforms to a single-curved convex surface (5), which leads all the way to an accept outlet (6). A screen (7) is located at adjustable distance from the curved surface (5) for dividing ingoing fibre/air flow into accept and reject. An outlet (10) for the reject is located behind the screen (7). At a distance of 10-150 mm from the accept outlet (6) a running air-pervious support (27) is located, on which the web precipitates.



Method and device for dry forming webs

This invention relates to the dry forming of webs.

Dry forming implies that the fibre material dispersed in air is caused to flow against a running forming wire. The fibres precipitate on the wire while the air passes therethrough. In commercially available plants for dry forming, the web is formed by using nets or screen plates, through which the fibres are to pass prior to their precipitation on the wire. The finer the net, the cleaner the web, but at the same time the fibre flow is reduced and an ever increasing amount of fibres are separated as reject and recycled for repeated defibration. The result is low capacity and degradation of the fibres. A further disadvantage is that the fibres easily can clog the holes in the net or screen and thereby cause non-uniform fibre distribution.

The present invention relates to a method and device for forming a web where the aforesaid disadvantages are eliminated. According to the invention, no nets or screen plates are used in connection with the forming, but undefibrated fibres are separated at a previous stage, and the distribution of the fibre material on the forming wire is brought about in that the fibre dispersion on its path to the forming wire is caused to flow along a curved surface. The characterizing features of the invention become apparent in greater detail in the claims.

The invention is described in greater detail in the following by way of an embodiment thereof and with reference to the accompanying drawings.

Fig. 1 shows a forming head according to the invention.

Fig. 2 is a basic flow diagram for a plant according to the invention. Fig. 3 is a flow diagram for a preferred embodiment.



The forming head 1 is provided with an inlet 2, which is designed so as to have successively decreasing height and increasing width. The cross-section of the inlet 2, thus, can transform from circular to rectangular. The final height of the inlet 2 is adjustable by means of a swing lip 3, which co-operates with the stationary lower wall 4 of the inlet. The lip 3 can be divided into individually adjustable sections for controlling the final height of the inlet 2 in the transverse direction and thereby controlling the transverse profile of the web. After the lip 3, the wall 4 transforms to a continuous single-curved convex surface 5, the radius of which must exceed 100 mm. This curved surface 5 leads to an accept outlet 6, which is so directed downwards that it forms an angle of about 90° with the inlet 2. Other angles between 45° and 180° , however, can also be used.

A screen 7 is located spaced from the curved surface 5 and extends along the entire width of the inlet, thereby forming a passage 8 between the screen 7 and curved surface 5. The narrowest section of the passage is defined by the leading edge 9 of the screen which is located after about half of the curved surface 5. The screen 7 being movable, the distance between the leading edge of the screen and the curved surface 5 can be varied. The screen 7 is substantially in parallel with a tangent to the curved surface 5 in a point directly in front of the edge 9. The screen 7 delimits the accept outlet 6 from a reject outlet 10.

Above the screen 7 an adjustable wall 11 is located, which together with the edge 9 of the screen defines a passage 12 above the screen 7. This passage 12 communicates with the reject outlet 10. The wall 11 is pivotal about a hinge 13 by means of an adjustable stay member 14. The wall 11 further is sealed against the upper portion of the forming head 1 by a sealing 15, thereby preventing return flow of the reject in the forming head.

The fibre material is supplied to the forming head in the form of fibres dispersed in air. The flow rate in the narrowest section of the inlet must exceed 100 m/sec. Hereby the fibres are dispersed which may have entangled (fibre fluff pieces). The incoming fibre/air flow deflects along the curved surface 5, which should be relatively rough so that the flow follows the surface without forming turbulence or give rise to other disturbances. The screen 7 divides the flow so that part of it containing the coarsest particles flows through the reject passage 12 while the remainder flows through the accept passage 8. The distribution between accept and reject can be determined by moving the screen 7. The distribution should be such that the accept flow is 25-75% of the incoming flow. The wall 11 prevents return flow of the reject in the forming head 1.

The accept is allowed to flow out through the accept outlet 6 down to a running air-pervious support, preferably in the form of a wire. The opening of the accept outlet to the wire should be 50-300 mm, calculated in the direction of movement of the wire. The width should be substantially equal to the width of the inlet 2. It is essential, however, that the fibre/air flow is laterally defined by walls all the distance from the inlet 2 to the accept outlet 6. On the lower surface of the wire a suction box can be located. The wire speed should be 50-1000 m/min, preferably 100-200 m/min. The accept outlet 6 should be located at a distance of 10-150 mm from the wire. As the web is being built up on the wire, the air perviousness of the wire decreases, thereby giving rise to a counterpressure in the accept outlet 6 and accept passage 8. Due to this counterpressure, the incoming fibre/air flow automatically is displaced to the reject passage 12, because the capability of the flow to follow the curved surface depends on the counterpressure in the accept flow. This means that upon increase of the web thickness on the wire the fibre supply decreases, and upon decrease of the web thickness the fibre supply increases.

Thereby a web with a very uniform web thickness (grammage) can be obtained. This web thickness is maintained automatically in the way described above. Grammage variations, thus, can be kept within 5%.

In Fig. 2 a basic flow diagram for an embodiment is shown. Fibre material is charged through a conduit 20 to a refiner 21 for defibration. The defibrated material is transferred through a conduit 22 to a screen 23. A conduit 24 from the accept side of the screen leads via a fan 25 to the forming head 1. The reject from the screen 23 is led via a conduit 26 to repeated defibration.

In the forming head the flow is divided into accept, which is precipitated on a running support 27, and reject, which via a conduit 28 entirely or partially is returned to the forming head 1. Part of the reject possibly can be returned via a conduit 29 for repeated screening in the screen 23.

The screen 23 can represent several single screens which, for example, can be cascade connected in a closed air circuit. An additional refiner can also be provided for reject refining. By carrying out a defibration as complete as possible of the material prior to its advancing to the forming head 1, the flow in the forming loop can be closed, i.e. all fibre material from the conduit 28 is returned to the forming head 1. Hereby the forming head is utilized exclusively for bringing about a web with uniform grammage, as described above.

Alternatively, part of the reject from the conduit 28 can be separated for repeated screening and re-defibration. The forming head 1 hereby also acts as a screen for separating coarse particles.

In Fig. 3 a preferred embodiment is shown. According to this embodiment, the fibre material is supplied in the form of bales to a bale shredder 30, from which the material is blown to a container 31. The air is separated in a cyclone 32. Thereafter fine shredding is carried out in a refiner 33, from which

the fibres are blown to a screen 34. The accept from this screen 34 is transferred via a cyclone 35 to the forming loop, which comprises a fan 25, a forming head 1, a forming support 27 and a reject conduit 28. The reject from the screen 34 is led to a second screen 36 where the reject is led to a reject refiner 37 for defibration while the accept is returned to the screen 34.

This arrangement implies that the forming loop is closed, i.e. all material allowed to enter the loop sooner or later will come out on the support 27.

EXAMPLE

At the embodiment according to Fig. 3 the operation conditions were as follows:

Radius of the curved surface (5)	200 mm
Distance between the screen (7) and curved surface (5)	25 mm
Distance between the outlet (6) and wire (27)	110 mm
Air speed in the narrowest portion of inlet (2)	144 m/s
Reject amount	60%

The following mechanical properties of a web of bleached sulphate pulp could be noted:

Web strength in machine direction	0,4 N/15 mm width
Web strength transverse to machine direction	0,3 N/15 mm width
Density	22 kg/m ³
Profile deviation in machine direction	± 3%
Profile deviation transverse to machine direction	± 3,3%
Grammage	176 g/m ²

The web obtained, thus, was very uniform. Of particular importance is the uniformity in strength along and transverse to machine direction.

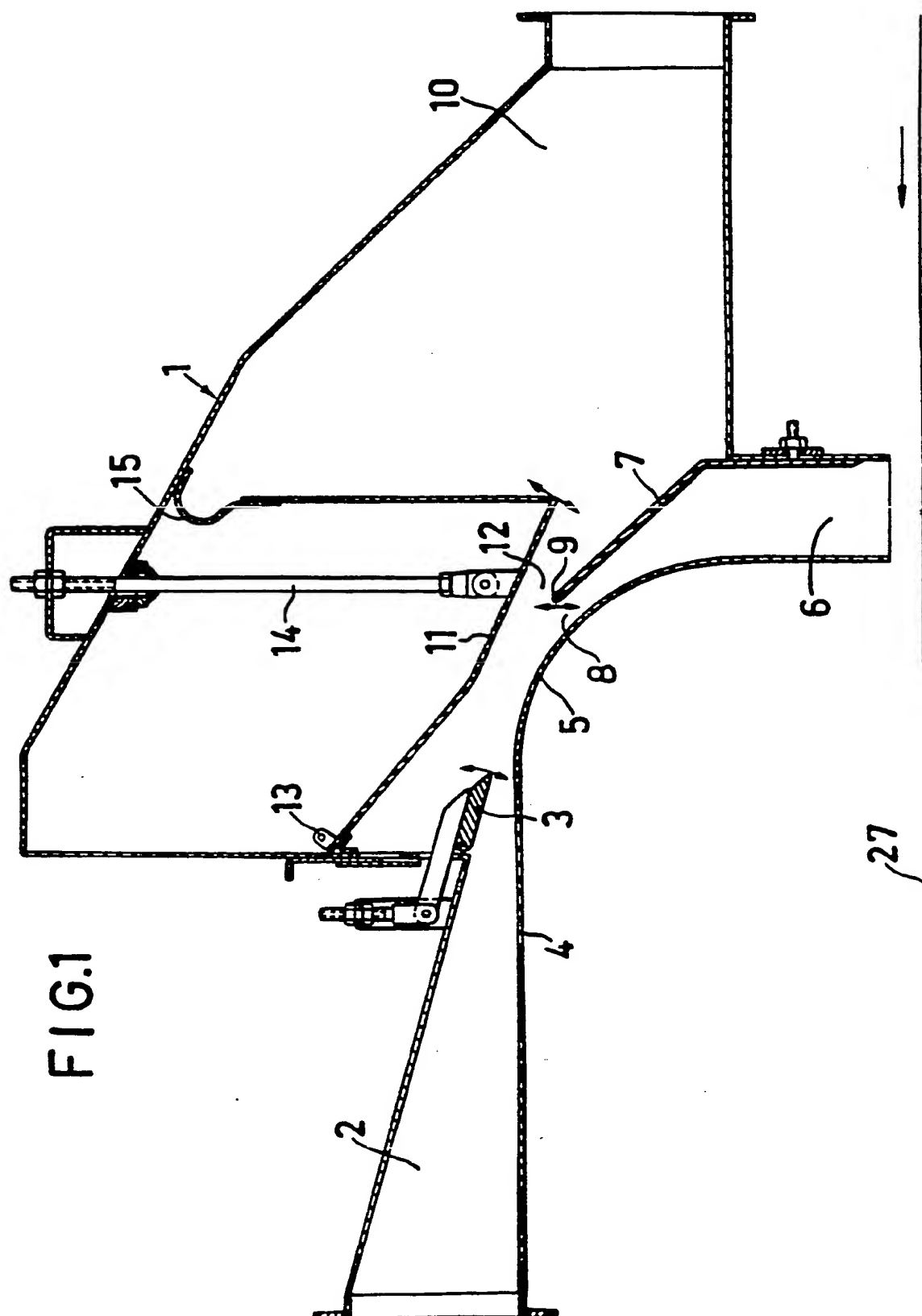
The invention, of course, is not restricted to the embodiment described, but can be varied within the scope of the invention idea.

C l a i m s

1. A method of dry forming a web by defibration of fibre material and dispersion of the fibres in an air flow and precipitation of the fibres on a running air-pervious support, c h a r a c t e r i z e d in that the fibre/air flow with a feed-in-speed exceeding 100 m/s is spread to
5 a layer with a width corresponding substantially to that of the completed web, that said flow is deflected between 45 and 180 ° along a single-curved convex surface, whereby centrifugal forces and shearing gradient forces act on the fibres, and that the part of the material flow which is least deflected is separated as reject, while the remainder as accept is
10 led to the running support where the air is sucked through so that the fibre material precipitates on the support and successively forms a web.
2. A method as defined in claim 1, c h a r a c t e r i z e d in that the reject flow is led in a closed flow loop and recycled together with new fibre material.
- 15 3. A method as defined in claim 1 or 2, c h a r a c t e r i z e d in that the accept is 25-75 % of the ingoing fibre material.
4. A device for dry forming a web, comprising a forming head (1) with an inlet (2) for the fibre material in the form of fibres dispersed in an air flow, and an outlet (6) for distributing the fibres on a running air-
20 pervious support (27), c h a r a c t e r i z e d in that the inlet (2) is formed so as to have a width corresponding substantially to the width of the completed web, that the inlet (2) transforms to a single-curved convex surface (5), which leads all the way to an accept outlet (6) which forms an angle of 45-180 ° with the inlet (2), that lateral walls are
25 provided for defining the flow all the way from the inlet (2) to the accept outlet (6), that a screen (7) is located at an adjustable distance from the curved surface (5) for dividing ingoing fibre/air flow into accept and reject, that an outlet (10) for the reject is located behind the screen (7), and that the support (27) is located at a distance of
30 10-150 mm from the accept outlet (6).
5. A device as defined in claim 4, c h a r a c t e r i z e d in that the inlet (2) and accept outlet (6) form an angle of about 90 °.
6. A device as defined in claim 4 or 5, c h a r a c t e r i z e d in that the inlet (2) is provided with a lip (3) adjustable in sections
35 for controlling the layer thickness of ingoing fibre/air flow in the transverse direction and thereby the transverse profile of the web.

7. A device as defined in any one of the claims 4-6, c h a r a c t - e r i z e d in that the leading edge (9) of the screen (7) is located after about half of the curved surface (5).

8. A device as defined in any one of the claims 4-7, c h a r a c t - e r i z e d in that a wall (11) is provided in order together with the screen (7) to define a passage (12) for the reject and to prevent return flow of the reject in the forming head (1).



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FIG. 2

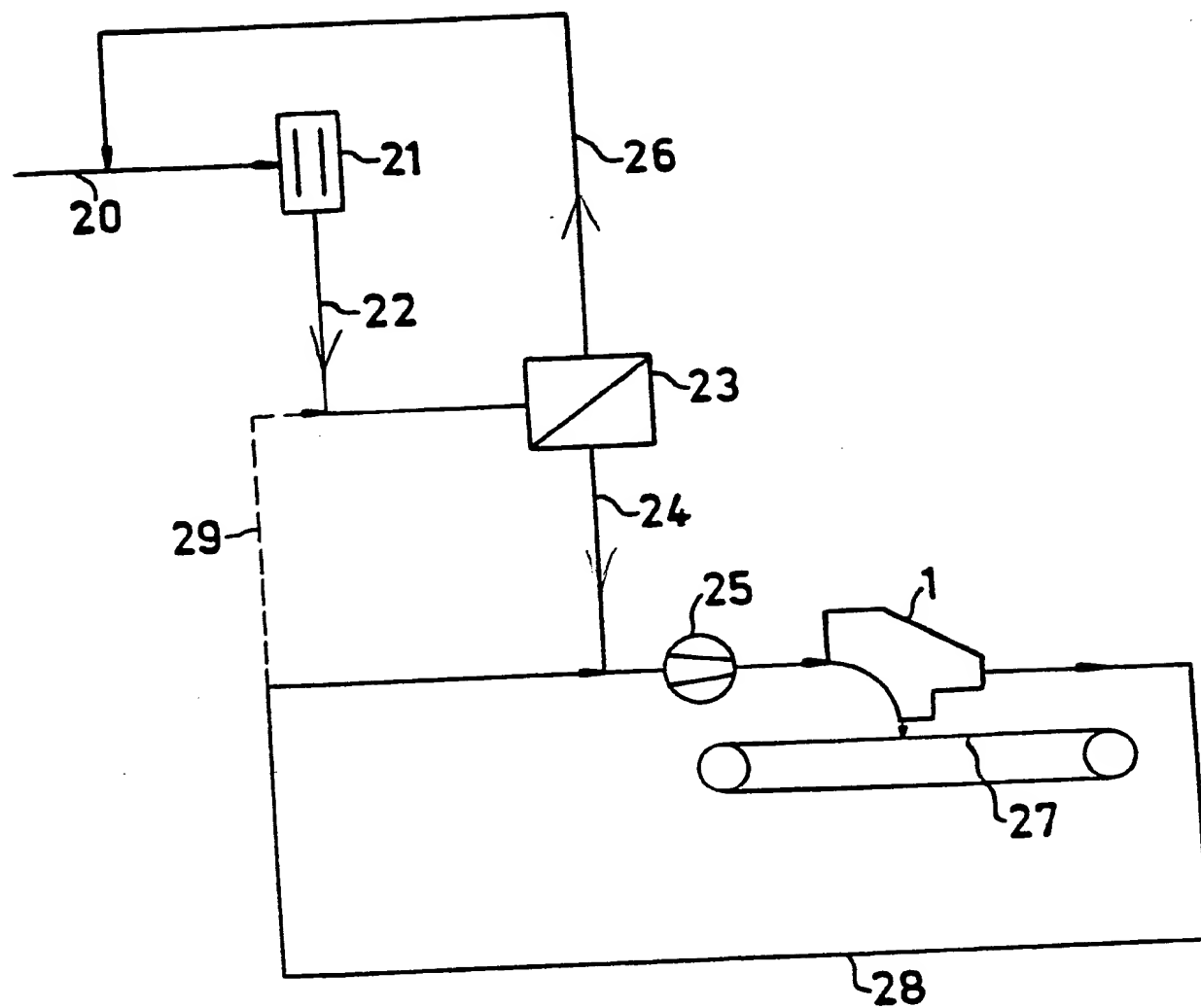


FIG. 3

